REMARKS

This is a full and timely response to the Office Action mailed July 27, 2004, submitted concurrently with a three month Extension of Time to extend the due date for response to January 27, 2005.

By this Amendment, claims 1 and 3 have been amended to put the claims in better form under U.S. practice. In addition, new claims 10-18 have been added to further protect specific embodiments of the present invention. In particular, new claims 15-18 are directed to different combinations of the subject matter of claims 1-5. Support for the claim amendments and new claims can be found variously throughout the specification and the original claims, see for example, pages 4, last 3 lines, and page 5 of the specification. Claims 1-18 are pending in this application with claims 6-9 being withdrawn.

In view of this Amendment, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

Claim of Priority

Applicant wishes to thank the Examiner for his acknowledgement of receipt and recording of the priority papers in the application file.

Rejection under 35 U.S.C. §112

Claim 1 is rejected under 35 U.S.C. §112, second paragraph, for alleged indefiniteness. Applicant respectfully traverses this rejection.

However, in order to expedite prosecution, Applicant has amended claim 1 to clarify that the term "*HDD*" stands for "*hard disk drive*". Applicant notes that this rejected term is well known to one skill in the art.

With regard to the Examiner's arguments that it is structurally indefinite as to how the insulating resin layer, the metal foil and the stainless steel substrate are "spatially" related, Applicant strongly disagree with the Examiner in this regard. The claims describe *a laminate constructed of an insulating resin layer and a metal foil successively formed on a stainless steel substrate.* In other words, the laminate of the present invention is made by building up an insulating polyimide resin layer and a metal foil successively on a stainless steel substrate.

Examples of laminates which fall within the scope of the claims can be found on page 11, lines 24-27, of the specification, and Figure 1 although the claims should not be limited to that which is disclosed or shown.

With regard to the Examiner's comments concerning whether or not there exist an adhesive between the polyimide layer and the stainless steel substrate and between the polyimide layer and the metal foil, Applicant believes that such comments are due to a lack of understanding regarding the present invention.

As stated in the background of the invention, due to the difficulties and cost in dry etching and the desire to substitute dry etching with wet etching, there has been a demand for materials suitable for wet etching. However, commercially available polyimide films such as Kapton of DuPont and Apical of Kaneka Corporation have high glass transition temperatures and do not possess sufficient adhesiveness to metals. Thus, they are not applicable for HDD suspensions requiring conductive circuits.

In contrast, the polyimide (B) of the present invention is properly selected for adequate adhesive strength and thus, are applicable for HDD suspension requiring conductive circuits. In other words, the adhesive strength comes primarily from the polyimide (B) itself. Thus, there is no lack of antecedent basis for "*the adhesive*".

It should be noted, however, that it is allowable to apply chemical or mechanical surface treatment to the stainless steel substrate and the metal foil for improving the adhesive strength between the layer of polyimide (B) and either the stainless steel substrate or the metal foil.

Further, it should also be noted that it is necessary for the glass transition temperature (Tg) of the polyimide (B) to be 300 °C or less since too high Tg deteriorates the adhesiveness and decreases the etching rate of the polyimide (B) while too low Tg deteriorates its heat resistance.

Thus, in view of the above comments, withdrawal of this rejection is respectfully requested.

Rejections under 35 U.S.C. §102

Claims 1, 2 and 5 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Shimose et al. (U.S. Patent 6,203,918). Applicant respectfully traverses this rejection.

To constitute anticipation of the claimed invention, a single prior art reference must teach each and every limitation of the claims. Here, in this case, Shimose et al. fail to teach the limitation "*the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C.*"

Specifically, claimed invention is directed to an "*hard disk drive (HDD) suspension to be obtained by processing a laminate which is constructed of an insulating resin layer and a metal foil successively formed on a stainless steel substrate, said laminate satisfying the following conditions;*

(1) the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C,

(2) the layers in the insulating resin layer which exist in contact with the stainless steel substrate and the metal foil are those of polyimide (B) exhibiting a glass transition temperature of 300 °C or less, and

(3) the adhesive strength between the layer of polyimide (B) and either the stainless steel substrate or the metal foil is 0.5 kN/m or more". It is also claimed in claim 2 that the insulating resin layer of the laminate comprises *at least one layer of low-thermal-expansion polyimide (A) exhibiting a coefficient of thermal expansion of 30 × 10^{-6}/ °C or less.*

Based on claims 1 and 2, the simplest examples of the insulating resin layer structure of the laminate of the present claims are represented as follows:

S/(B)/M (corresponding to one of many embodiments in claim 1)

S/(B)/(A)/(B)/M (corresponding to one of many embodiments in claim 2)

(wherein (A) denotes a polyimide resin layer (A), (B) denotes a polyimide resin layer (B), S denotes a stainless steel substrate, and M denotes a metal foil). However, Applicant notes that other examples within the scope of the claims are also possible (see, for example, page 11 of the specification).

In order to produce the claimed HDD suspension from the laminate, the outer stainless steel substrate ("S") and metal foil ("M") are each first subjected to etching into a predetermined pattern. Then, the insulating resin layer ((B), or (A) and (B)) is subjected to etching by using the patterned S and/or M as resists.

To satisfy the requirements of HDD applications, the laminate of the present invention must 1) prevent warping and 2) have a high bonding strength between the resin and metal foil, or resin and stainless steel substrate. As discussed in the present specification and shown in the Examples, the prevention of warping can be attained by using a polyimide resin layer (A) having a low coefficient of thermal expansion (i.e. CTE of 30×10^{-6}/°C or less) similar to the CTE of the metal foil or stainless steel substrate, and providing a sufficiently thick laminate of polyimide resin layer (A)/(B). The high bonding strength between the resin and the metal foil or stainless steel substrate is attained by providing a polyimide resin (B) having a low glass transition temperature (i.e. Tg of 300°C or below) in contact with the metal foil or stainless steel substrate.

The high bonding strength and low coefficient of thermal expansion cannot be satisfied with one kind of polyimide resin. Prior art laminates focused on satisfying a low coefficient of thermal expansion and obtaining sufficient bonding strength. The rate of etching of the laminate and the insulating resin layer was not at all considered.

In general, polyimide resins (A) have a high rate of etching while polyimide resins (B) have a low rate of etching. A low rate of etching for polyimide resin (B) results in a long period of time between the start of the etching of polyimide resin (B) (*at the completion of etching of polyimide resin (A)*) and the completion of etching of polyimide resin (B) (*whereby the etching reaches the metal foil or stainless steel substrate*). During such a long period of time, the continued etching of other polyimide resin layers such as polyimide resin layer (A) may also proceed. However, the continued etching of the other polyimide resin layers proceeds not in the thickness direction but in the width direction, which is referred to as "*side etching*". When side etching occurs, precise etching cannot be performed since the portion of the resist larger than the patterned opening portion is also etched. Such problems have become more serious and important due to the increasing demand for fine interconnection structure.

The present invention solves these problems by teaching a insulating resin layer comprising "*plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C*" to thereby minimize the problems of side etching. In other words, the present invention specifies the rate of etching of the whole resin and the rate of etching of polyimide resin layer (B). Further, additional claims have been added (see new claims 10-14) to specify the ratio of thickness of polyimide resin layer (A) and (B) and the rates of etching of

polyimide resin layer (A) and (B) to minimize side etching. Such a structure and effect in the pending claims are not at all disclosed in the cited references.

Shimose et al. defines its rate of etching by immersing the layer of polyimides in 100% hydrated hydrazine at 50°C which is not equilvalent to the "*50% aqueous solution of potassium hydroxide at 80°C*" defined by the present claims. Nevertheless, since the rate of etching depends on the resin structure (i.e. monomer composition) of the polyimides resins, the inventors of the present application have measured the etching rate of the adhesive polyimide described in Shimose et al. under the conditions described in the specification of the present invention.

Based on the measurements shown in Table 1 below, it is clear that Shimose et al. does not teach any adhesive polyimide possessing *a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C,*

TABLE 1

Polyimide C (Synthetic example 3)	0.3 μm/min
Polyimide D (Synthetic example 4)	0.3 μm/min
Polyimide E (Synthetic example 5)	0.1 μm/min
Polyimide F (Synthetic example 6)	0.1 μm/min or less

The laminate containing the adhesive polyimides described in Shimose et al. as an adhesive layer was subjected to etching by an aqueous solution of potassium hydroxide in order to obtain an HDD suspension. The low etching rate of the adhesive polyimide in Shimose et al. provided a polyimide layer of a protruding shape like a canopy, and as a result, practical HDD suspension was not obtained. This result is similar to that of Comparative Example 1 described in the specification of the present invention, which supports that the etching rate of the polyimide (B) of the present invention is important.

Thus, in view of the above arguments, withdrawal of this rejection is respectfully requested.

Rejection under 35 U.S.C. §103

Claims 1-5 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Shimose et al. (U.S. Patent 6,203,918) in view of Mochizuki et al. (U.S. Patent 5,578,696) or Takabayashi et al. (U.S. Patent 5,262,227). Applicant respectfully traverses this rejection.

To establish a *prima facie* case of obviousness, the cited references, in combination, must teach or suggest the invention as a whole, including all the limitations of the claims. As stated for the reasons outlined above, Shimose et al. fail to teach the limitation "*the insulating resin layer having plural layers of polyimides and every constituent layer of the insulating resin layer exhibits a mean etching rate of 0.5 μm/min or more by a 50% aqueous solution of potassium hydroxide at 80°C.*" Such a deficiency in Shimose et al. is not cured by the teaching and suggestions of Mochizuki et al. or Takabayashi et al.

As stated earlier, the rate of etching depends on the resin structure (i.e. monomer composition). Based on the experiments conducted by the inventors of the present invention, all polyimides disclosed in Mochizuki et al. or Takabayashi et al. presumably have low etching rates.

The raw materials of the polyimide resin used in Mochizuki et al. are described below. Based on inventor's experimental data, the rates of etching of the polyimide resin produced from these raw materials are too low as compared to the present invention.

Synthetic examples of the polyimide resins shown in Mochizuki et al. are as follows.

Example 1: 4,4'-diaminodiphenyl ether (DAPE44) and 2,2'-bis(3,4-dicarboxyphenyl) hexafluoropropane (6FDA).

Example 3: bis[4-(4-aminophenoxy)phenyl]propane (BAPP) and 4,4'-hydroxy diphthalic acid dianhydride (ODA)

Example 7: 2,2-bis(trifluoromethyl)-4,4-diaminobiphenyl (mTB) and 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA)

Synthetic Examples C and L in the specification of copending patent application 10/467,463 show the low rate of etching of polyimide using BAPP (0.2 μm/min or less). Further, Synthetic Example S of patent application 10/467,463 shows the expected low rate of etching of polyimide using s-BPDA (0.1 μm/min). Thus, as demonstrated by the experimental data of copending patent application 10/467,463, the polyimide resins shown in Mochizuki et al. do not satisfy the rate of etching requirement of the present claims.

Likewise, Takabayashi et al. (U.S. Patent 5,262,227) also fails to teach or suggest the rate of etching required by the present claims. Example 1 of Takabayashi et al. describes a polyimide formed from 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA) and 4,4'-diaminodiphenyl ether (DAPE44) and a polyimide formed from 3,3',4,4'-biphenyltetracarboxylic acid dianhydride (s-BPDA) and p-phenylenediamine (p-DAP).

Synthetic Example S in the specification of copending patent application 10/467,463 describes the low rate of etching of polymide using BPDA (which corresponds to s-BPDA). Such a conclusion is shown by the relationship between the composition of diamines and acid dianhydrides constituting polyimides and the etching quality from Table 3 of the Examples. In Table 3, S (polyimide) is prepared from BPDA and PMDA as acid dianhydride components, and APB and p-DAP as diamine components, and its etching quality is evaluated. The resulting rate of etching of 0.1 μm/min falls dramatically short of the lower limit (i.e. 0.5 μm/min) of the present invention. Although there is a little difference in the composition of raw materials, Q and R, prepared from the same diamine components as S, showed good etching quality. Thus, the inferior etching quality of S unquestionably results from the use of BPDA.

Therefore, the polyimide used in the laminate of Takabayashi et al. does not satisfy the rate of etching required by the present claims.

Thus, in view of the above arguments, withdrawal of this rejection is respectfully requested.

Obviousness-Type Double Patenting Rejection

Claims 1-5 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5 of copending Application No. 10/467,463. Applicant respectfully traverses this rejection.

Under U.S. case law, a double patenting rejection of the obviousness-type is "analogous to [a failure to meet] the nonobviousness requirement of 35 U.S.C. § 103. *In re Braithwaite, 379 F.2d 594, 154 U.S.P.Q. 29 (CCPA 1967).* Therefore, any analysis employed in an obviousness-type double patenting rejection parallels the guidelines for analysis of a 35 U.S.C. § 103. *In re Braat, 937 F.2d 589, 19 U.S.P.Q.2d 1289 (Fed. Cir. 1991).*

Thus, to establish a *prima facie* case of obviousness, claims 1-5 of copending Application No. 10/467,463 must teach or suggest the invention as a whole, including all the limitations of the claims. Here, in this case, claims 1-5 of copending Application No. 10/467,463 fails to teach or suggest "***an hard disk drive (HDD) suspension*** *to be obtained by processing a laminate which is constructed of an insulating resin layer and a metal foil successively formed on* ***a stainless steel substrate***". In particular, claims 1-5 of copending Application No. 10/467,463 fails to teach or suggest the specific elements of "*an hard disk drive (HDD) suspension*" and "*a stainless steel substrate*".

Thus, for these reasons, withdrawal of this rejection is respectfully requested.

CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

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Respectfully submitted,

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